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Short Communication

Returning home: movement strategies of Sub-Andean birds in a modified landscape

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Abstract

We documented movement of a long-distant migrant (Swainson's Thrush *Catharus ustulatus*) and two understory resident species (Chestnut-capped Brush-finch *Buarremon brunneinuchus* and Streak-capped Treehunter *Thripadectes virgaticeps*) in a fragmented landscape dominated by a pasture matrix in a Sub-Andean region of central Colombia. Swainson's Thrush had no detectable difficulties traversing a pasture matrix and returning to the capture site. Chestnut-capped Brush-finch and Streak-capped Treehunter (understory resident species) avoided making lengthy flights and used stepping-stones and nearby corridors to ease their movement. Providing stepping stones such as live fences and isolated trees and maintaining corridors can enhance functional connectivity in regions with fragmented forests, aiding the conservation of bird species.

Key words: Colombia, forest fragmentation, landscape matrix, land-use change, radio-telemetry

Resumen

Documentamos el movimiento de un migrante de larga distancia (*Catharus ustulatus*) y dos especies residentes de sotobosque (*Buarremon brunneinuchus* y *Thripadectes virgaticeps*) en un paisaje fragmentado dominado por una matriz de pastos en la región subandina del centro de Colombia. *Catharus ustulatus* no tuvo ninguna dificultad detectable en atravesar la matriz de pastos y regresó al sitio de captura. Por otro lado, *B. brunneinuchus* y *T. virgaticeps* (las especies residentes de sotobosque) evitaron hacer vuelos prolongados y utilizaron árboles aislados y corredores cercanos para facilitar su movimiento. Implementación de pasaderas como cercas vivas y árboles aislados, y el mantenimiento de corredores puede contribuir a la conservación de aves mediante la mejora de la conectividad funcional en regiones con bosques fragmentados.

Palabras clave: Colombia, fragmentación de bosque, matriz del paisaje, uso de suelo, radio-telemetría

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Introduction

Despite the high levels of bird diversity supported by tropical forests, species declines are occurring at unprecedented rates [1-4]. The main factors associated with reduced numbers of species are habitat loss and fragmentation [*e.g.*, 5]. In fragmented landscapes, forest patches tend to be interspersed within an open-habitat matrix. The open habitat is often significantly different from the forest habitat in structure and resources availability and therefore may disrupt natural movement patterns. The tendency to move between patches and cross a matrix varies widely among species [6]. For example, large-bodied species and habitat generalists are more likely to cross gaps between forest patches than understory and forest-restricted birds [7, 8]. Tropical birds' reluctance to move into open habitat has been associated with naturally low levels of dispersal abilities [9, 10]. Low levels of dispersal increase the likelihood of local extinction by preventing individuals from occupying remaining patches [11, 12] which could be a mechanism responsible for the loss of several tropical birds [10].

Translocation experiments [13] are used to assess birds' ability to cross a matrix. Such experiments reveal that the size of the gap between capture site and release site influences the probability and speed of return for many forest-dwelling species [14, 15]. However, most studies have been performed in lowland areas. Lowland and montane birds differ in trophic structure and taxonomic composition [16], and the small geographic ranges and narrow habitat requirements of montane species [17, 18] make them particularly vulnerable to forest fragmentation. In addition, it is uncertain whether montane birds venture into and cross an open-habitat matrix.

In this study, we report return trajectories of the Neotropical-migrant Swainson's Thrush (*Catharus ustulatus*, Turdidae) and two tropical resident species, the Chestnut-capped Brush-finch (*Buarremon brunneinuchus*, Emberizidae) and the Streak-capped Treehunter (*Thripadectes virgaticeps*, Furnariidae), facing the same challenge of crossing a pasture matrix to return home in a Sub-Andean region. The Swainson's Thrush is a long-distance migrant that inhabits montane forest and forest borders in its winter grounds [19]. Therefore, it is expected to cross a matrix in a single flight. The Chestnut-capped Brush-finch is a resident frugivore-insectivore that forages on the ground and inhabits forests, but also uses a matrix of exotic-tree plantations [20]. The Streak-capped Treehunter is a resident insectivore that forages on the understory, inhabits

forests, and is absent in exotic-tree plantations and pasture matrices [20]. Both resident species are likely reluctant to cross a pasture matrix.

Methods

The study region was located 2.5 km northeast from the municipality of Filandia, Quindío, on the west slope of the Cordillera Central of the Colombian Andes (04.68 N and 75.65 W; ~1,900 m; Fig. 1a). The region is characterized by forest remnants embedded within a matrix of pastures and, to a lesser extent, exotic-tree plantations [20]. Two larger forest tracts (Barbas river canyon – 731 ha, and Bremen – 840 ha) are connected through four restored corridors, established between 2003 and 2006. The four corridors resemble the vegetation structure and composition of secondary forests and include threatened tree species [21].

We captured, measured, and translocated one individual of Swainson's Thrush, one individual of Chestnut-capped Brush-finch, and two individuals of Streak-capped Treehunter from 16 January to 26 January 2013. We captured birds (time capture from 0600 h until 1100 h daily) in forest tracts or corridors using 10 nylon mist nets (9.0 x 2.5 m and 12 x 2.5 m, 16 mm mesh) and determined species and when possible, sex and age. We equipped birds with a small radio transmitter (BD-2G, Holohil Systems Ltd. Ontario). To avoid any harm and impact on individual bird behavior, the transmitter was restricted to 1.2 g, corresponding to < 5% mean body mass as recommended by the Resources Inventory Committee [22]. We constructed a breakaway harness out of elastic plastic band to which the transmitter was attached with a small drop of adhesive eyelash glue; details have been previously described by Naef-Daenzer [23]. After checking the fit of the harness, we placed individuals in cloth bags to avoid injuries and reduce stress while moving them to the release location. Time between capture and release location was on average 29 ± 10 min.

We released individuals 144 to 250 m away from their capture sites in a landscape matrix consisting of pasture for cattle and single trees (Fig. 1b). To track birds' movements and determine locations through 'homing-in', we followed the birds using VHF radio-telemetry with a hand-held Yaesu VR-500 receiver and a modified hand-held H-aerial antenna (Wagener, Köln) as an aid to visually locating them continuously during tracking. For each confirmed observation, we recorded a GPS location using a conventional hand-held GPS (Garmin GPSmap 62st). In cases where we lost sight of the individual, we estimated the bird position using differential compass bearings towards the strongest transmitter signal and used the software Locate III vs. 3.34 [24] for triangulation. Using both visually determined and triangulated position, we reconstructed the movement paths of each of the released birds.

Capturing and handling of birds were performed in compliance with legal requirements. Research permits were granted by the "Corporación Autónoma del Quindío (CRQ)." All birds were handled with best practice following the guidelines of the bird banding laboratory "Vogelwarte Radolfzell" [25], and we minimized suffering through swift release into the wild and professional harnessing techniques as recommended by the permit authorities.

Results

Return trajectories after translocation varied among the three species (Fig. 1b). Swainson's Thrush crossed a gap of 255 m in one flight in the direction of the capture site at Bremen forest. Upon release, Chestnut-capped Brush-finch flew directly to an isolated tree 48 m away and stayed there for 23 min. The second path segment was 55 m long and was followed by a final

movement 58 m long before entering the landscape corridor. It followed the corridor until it arrived at the capture site on the third day. Both individuals of Streak-capped Treehunter flew 119 m and 127 m directly to the corridor. Three days after release, the estimated location of one individual was 75 m from the capture site. The second individual flew directly to the corridor where it stayed for the remainder of the tracking period.

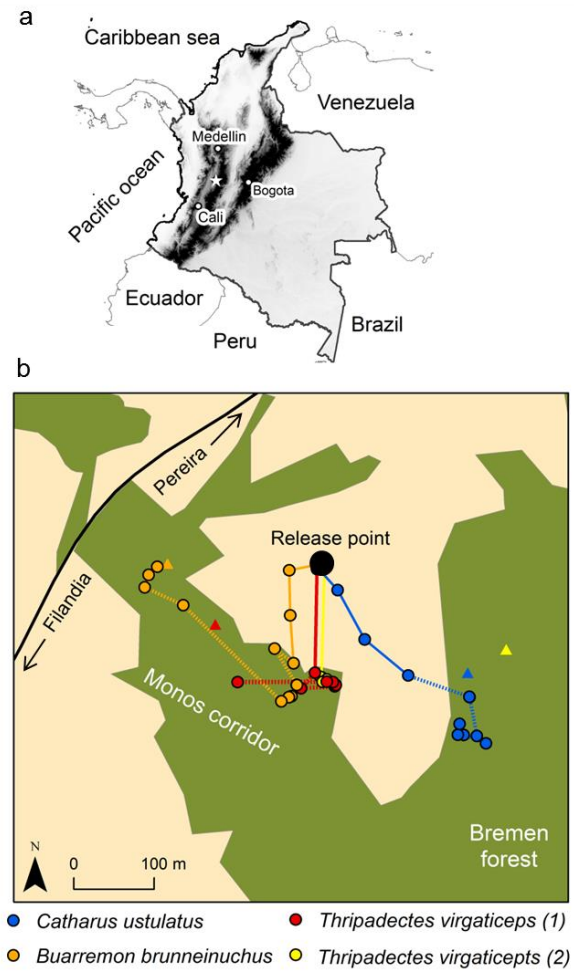

Fig. 1. Location of the study area in the western slope of the Cordillera Central of the Colombian Andes (a). Return paths of four individuals of three different species once translocated from capture sites (*triangles*). *Circles* represent estimated locations for each individual, *solid line* and *dashed line* denote observed path and likely traversed path by each individual, respectively (b).

Discussion

The results from our relocation experiment indicate distinct movement strategies by the study species for returning to capture sites. As expected, the Swainson's Thrush had no apparent problem moving back to the capture site. For this long-distance migrant, traversing an open-habitat matrix does not present a challenge, at least for the translocation distance used in our study.

Conversely, resident forest-dwelling species seemed more reluctant to cross a pasture matrix. The Chestnut-capped Brush-finch used stepping-stones to reduce flying distance from 130 m in a single flight to an average of 54 m paths. Similar behavior has been recorded for Lesser Woodcreeper (*Xiphorhynchus fuscus*), a resident insectivorous bird in the Brazilian Atlantic forest [26]. Once in the corridor, the Chestnut-capped Brush-finch did not have any difficulty moving through forest habitat and returning to its source location, as seen in other tropical lowland species [14].

In contrast, for the Streak-capped Treehunter translocation distance increased the difficulty of returning to its source location. Both individuals flew directly to the closest corridor. The individual translocated 144 m (gap distance of 119 m) took three days to return to its source location, whereas the other Streak-capped Treehunter individual, translocated 250 m (gap distance of 172 m), did not return during the tracking period. These results suggest potential reluctance to cross wide inter-habitat gaps, as have been documented in other species in tropical lowland and boreal forests [14, 26, 27]. Presumably the absence of cover and perches in a pasture matrix may hinder, or at least delay, understory birds' decision to traverse open-habitat matrix [28, 29].

Implications for conservation

Tropical forests still have high levels of bird diversity, but habitat loss and fragmentation are eroding the number of species [*e.g.,* 5, 10]. The response of tropical birds to fragmentation can be driven by their naturally low levels of dispersal abilities [10]. Montane birds are particularly vulnerable to forest fragmentation because of their narrow habitat requirements and small geographic ranges [17, 18]. We provided preliminary information on movement patterns of a few montane tropical birds, showing that the willingness to venture into and cross an open-habitat matrix depends on their life history. Although we have a small sample size, forest-dwelling species tend to avoid making lengthy flights, and the existence of stepping-stones and nearby corridors eases their movement. Thus, the use of stepping stones and maintaining or reestablishing corridors may enhance functional connectivity between large forest tracts and aid the conservation of bird species in regions with fragmented forests.

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